Appendix A: Summary of Operable Units not Covered by the 1989 Record of Decision

Overview

In 1987, the East Helena superfund site was separated into five Operable Units (OUs) as follows;

OU1 - Process Ponds: including Lower Lake, the speiss granulating pond and pit, the acid plant water treatment facility, former Thornock Lake, and the process fluids circuitry.

OU2 - Groundwater: including shallow groundwater under the plant, and a plume of contaminated groundwater that extended beyond the boundaries of the smelter site and into the shallow aquifer underlying a portion of East Helena.

OU3 - Surface Soils, Surface Water, Vegetation, Livestock, Fish and Wildlife, and Air: including plant Site soils, residential East Helena soils, other Helena Valley soils, Prickly Pear Creek, and Wilson Irrigation Ditch

OU4 - Slag Pile: including the approximately 35-acre slag pile and any contaminated soil under the slag pile.

OU5 - Ore Storage Areas: including air, groundwater and surface water.

In 1989, a Record of Decision was issued to address the Process Ponds (OU1). The first five-year review (1999), triggered by the Remedial Action Start Date of July 1, 1992, discussed all five OU's. The second five-year review specifically addresses OU1, and its associated remedial actions. Because a decision document has not been produced for the other 4 OU's, the general extent of contamination and the remedial actions taken to date have been summarized only in this Appendix A.

In addition, EPA Region 8 changed the Operable Unit designations for the East Helena Site. Currently, EPA recognizes two Operable Units associated with the Superfund Site; these include OU1 – Process Ponds, and OU2 - Surface Soils, Vegetation, Livestock, and Fish and Wildlife.

EPA divided responsibilities for the OU's between Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA) authorities. In general, CERCLA has been the governing agency for the re-defined OU2 (surface soils, vegetation, livestock, and fish and wildlife), and RCRA has been the

governing agency for all other aspects of the site. RCRA will continue to be the governing authority for these other OU's (although the RCRA program does not use the 'Operable Unit' designation) and other corrective actions related to the former plant site. CERCLA will continue to be the governing authority for the re-defined OU2 including the on-going cleanup of residential and agricultural soils.

This Appendix briefly summarizes the originally designated five OU's. However, in an effort to avoid confusion the Operable Unit designations have been removed.

Remedial actions taken to date for areas other than OU1 were done under the authority of RCRA, the Montana Clean Air Act, and in accordance with a Administrative Order on Consent (AOC) between EPA and Asarco, and the Remedial Investigation/Feasibility Study (RI/FS).

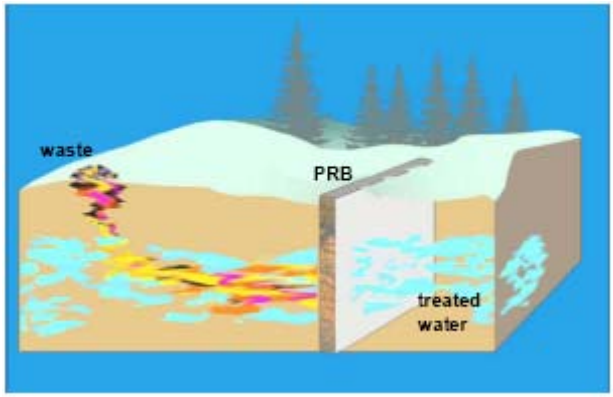
This is not a comprehensive review of all activities on the site, it is a summary only.

Groundwater

The groundwater operable unit includes shallow groundwater under the plant, and a plume of groundwater contaminated primarily by arsenic that extends beyond the boundaries of the smelter site and into the shallow aquifer underlying a portion of East Helena.

Current concentrations of arsenic in the ground water near the former metal-smelting facility are up to 5,000 times the current EPA drinking water standard of 10 parts per billion.

An experimental permeable reactive barrier (PRB) was installed in 2005 near the north edge of the plant to slow any additional spread of contamination from the groundwater plume under the site. The specific plume targeted by the PBR is about 450 feet wide and extends 2,100 feet down gradient from the plant site. The PRB includes a wall of iron filings placed below the surface where a chemical reaction is expected to take place, in which the arsenic in the groundwater will attach itself to rust on the iron filings. Figure A-1 shows the location of the groundwater plume and the groundwater monitoring wells. Preliminary results indicate that arsenic concentrations as high as 20 mg/L in ground water entering the PRB are reduced to concentrations below 10 µg/L within the barrier. Concentration reductions down gradient of the PRB will be evaluated after construction impacts subside and the ambient groundwater flow system is re-established.



Arsenic is the contaminant of primary concern in ground water. It has been believed that contaminated ground water does not pose a threat because it is not used for domestic water supply and there is no direct human contact. However, EPA's RCRA program recently found evidence of arsenic contamination at concerning concentrations in the intermediate zone of the aquifer underlying East Helena. This sampling also shows that the known arsenic groundwater plume has recently migrated toward a residential area. The plume was previously contained in the shallow aquifer, but has now reached the intermediate aquifer, from which nearby residences draw their well water. A groundwater sample taken 3 blocks (about ¼ mile) up-

gradient from the residential wells, detected arsenic at 4,900 ppb, a value that is 490 times higher than EPA's standard for public drinking water. (ATSDR 2002).

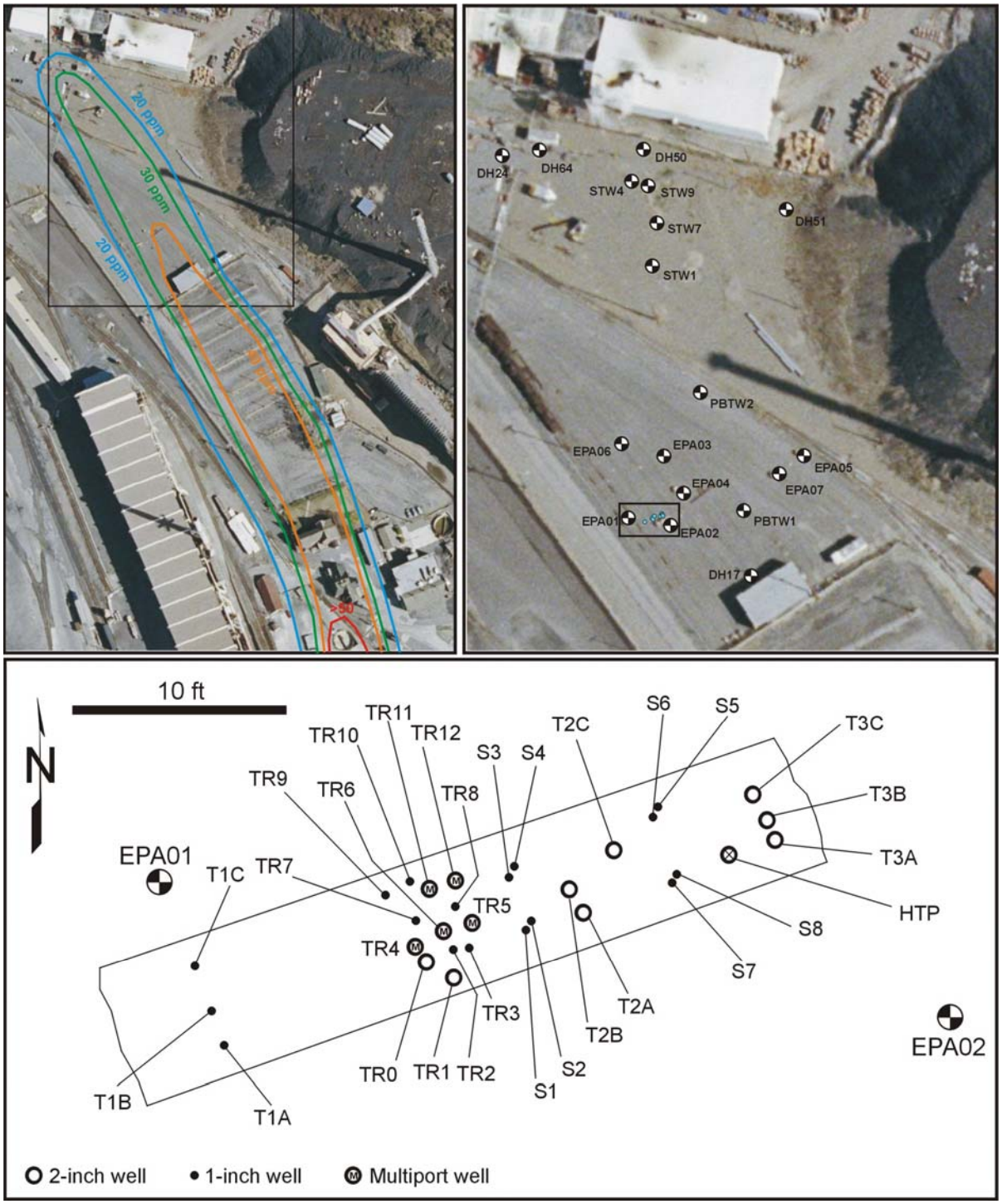


Figure A-1. Permeable Reactive Barrier

Surface Soils, Surface Water, Vegetation, Livestock, Fish and Wildlife, and Air

Surface Soils

In 1991, EPA and Asarco entered into an Administrative Order on Consent (AOC) to begin a residential soil removal action on a non-time critical basis. Removal of soils with high concentrations of lead, cadmium, arsenic, and other hazardous substances from residential yards, parks, roads, alleys, and road aprons has been ongoing since the spring of 1991. Lead is the primary contaminant of concern for OU3 and triggered the yard removals

As of February 2006, 1,227 sites have been cleaned up. Of these properties, 543 were residential sites, 32 were commercial sites, and 36 were vacant lots. The remaining sites include road aprons, alleys, schools, parks, flood channels, and flood ditches. The following table summarizes soil remediation that has occurred since the last 5-year review:

Table A-1. Soils Removed Since the 1999 Five-Year Review

Year	Type	Number
1999	Residential	6
	Vacant lot	1
	Flood channel	1
2000	Residential	12
	Vacant lot	3
	Flood channel	11
2001	Residential	12
	Road Apron Sections	2
	Flood channel	13
2002	Residential	9
	Flood channel	79
2003	Residential	9
	Vacant lots	2
	Road April Sections	5
2004	Residential	6
	Vacant Lots	5
	Flood channel	1

Blood lead studies performed when the plant was operating indicated a high frequency of children with elevated blood lead levels (> 10 ug/dL), and the

frequency was correlated with proximity to the smelter. Continuing studies of blood lead in children in East Helena have demonstrated a decreasing time trend, and values are now generally below EPA's level of concern, as shown in Table A-2:

Table A-2. Blood Lead Levels in Children in East Helena

Year	Number. of Blood Samples	Number Greater than 10 µg/dl	Average
1995	82	7	5.6 µg/dl
1996	95	5	4.3 µg/dl
1997	89	13	5.6 µg/dl
1998	137	7	3.9 µg/dl
1999	66	5	6.6 µg/dl
2000	190	6	3.7 µg/dl
2001	135	0	2.4 µg/dl
2002	44	0	2.0 µg/dl
2003	200	0	~ µg/dlb

Notes: Children - 1 month to 72 months of age

Average not calculated in 2003 because a high percentage were below laboratory detection limits.

Elevated blood lead is defined by the Center for Disease Control as that greater than 10 mg/dl.

Source: Asarco Inc., 2004. "East Helena Residential Soils Removal Action, 2003 Year End Report." Prepared by: Randall Contracting, Inc., June.

The Integrated Exposure Uptake Biokinetic Model (IEUBK) software program is used to predict the risk of elevated blood levels in children who are exposed to lead in the environment. Several studies were conducted in 2003 to provide site specific input data for the IEUBK model related to the East Helena Superfund Site. An in-depth discussion of the IEUBK model and any associated results is beyond the scope of this Five Year Review.

This improvement in blood lead levels over time is likely attributable to a combination of factors, including: a) extensive remedial actions taken at the smelting site that have decreased the release of highly contaminated dusts into air; b) the on-going clean-up of elevated soils in residential areas; and c) national programs to decrease lead in air, food, water, and other products.

Another factor that is also likely to be important in the decreasing blood lead levels is the operation of the Lewis and Clark County Lead Education and

Abatement Program. This program was set up in June 1995 and opened an office in East Helena in August, 1995. This program works in five major areas including lead education, health intervention and childhood blood screening, development and implementation of institutional controls, environmental assessment and sampling, and multi-pathway lead abatement. The program has successfully educated and screened area children for blood lead levels since 1995.

Over the course of the removal action, excavated contaminated soils have been land stockpiled in a fenced area on a portion of Asarco's property located directly east of the smelter. A 1993 Modification to the Administrative order provided for soil placement onto the Asarco East Fields, instead of into the stockpile. The East Fieldsconsist of about 225 acres. The residential soils are hauled by truck and spot dumped in locations determined by their estimated soil lead concentrations.

It is reasonably anticipated that the future land use of existing residential properties will remain residential and that, based on historical growth patterns, new residential subdivisions will be developed on existing agricultural or undeveloped lands. Some of the agricultural lands will remain as productive agricultural resources. Some undeveloped lands, such as the East Fields, will be used as contaminated soil repositories and consequently will remain unsuitable for future development.

According to the East Helena Residential Soils Removal Action 2003 Year End Report, of the 2,200 identified sites that have been sampled, there are approximately 236 properties that have not been remediated and have lead levels that qualify for remediation. This list varies from year to year depending on the number of new sites that have been sampled or added to the qualifying list and/or have been remediated. The East Helena Residential Soils Project is ongoing.

Surface Water - Wilson Irrigation Ditch

Water is diverted to Wilson Ditch from Upper Lake for irrigation use. The quality of water in Wilson Ditch is essentially the same as Prickly Pear Creek upstream of the ASARCO plant. However, at one time a conveyance canal or conduit passed through the outside ore storage area. Elevated lead and arsenic levels found in the bottom sediments collected from Wilson Ditch are believed to have originated from careless handling of ores and concentrates near the conveyance canal or conduit. In 1993 and 1994 approximately 3,700 lineal feet of ditch were excavated and backfilled with clean soils under authority of the AOC. No further response action is required for the Wilson Ditch.

Surface Water – Prickly Pear Creek

Prickly Pear Creek exhibits a measurable impact in terms of water and sediment quality, and Prickly Pear Creek is listed by the State of Montana on the 303(d) list of impaired waters. Probable sources of impairment include mine tailings, acid resource extraction, mine drainage, abandoned mining, and contaminated sediments. It should be noted that elevated metals and altered habitat are found as much as 20 miles upstream from the Asarco smelter, where parties other than Asarco conducted mining and smelting for decades. A Total Maximum Daily Load will be developed for Lake Helena, and may include elements to address water quality in Prickly Pear Creek.

In 2003, MDEQ cited Asarco for violations of the Clean Water Act and for hazardous waste storage on the Site. Asarco was cited for discharging process wastewaters containing pollutants from its High Density Sludge Treatment Facility to Lower Lake, which is hydrologically connected to Prickly Pear Creek. Subsequent correspondence lead to a 2005 Consent Decree which required Asarco to develop and implement yearly work plans for calendar years 2004-2006 to remove, store, and properly dispose or recycle all remaining hazardous waste and recyclable materials located in the process units, pollution control devices, tank and storage units, and other identified areas of the Facility.

Vegetation

Vegetable and grain crop surveys were conducted during the remedial investigation to define the patterns of production and consumption of vegetables grown in the East Helena area, and of wheat grown in the Helena Valley. The elevated metals levels in garden vegetables prompted a set of recommendations from EPA and Montana Department of Environmental Health and Sciences (now Montana Department of Environmental Quality [MDEQ]) for the safe handling of vegetables grown in East Helena gardens. Suggestions included limiting the consumption of leafy vegetables, peeling and washing vegetables grown underground, and thoroughly washing other vegetables and fruits. Education regarding consumption of locally grown vegetables is provided to the East Helena community through the Lewis and Clark Lead Education and Abatement Program.

There are considerable undeveloped lands outside the East Helena residential area with soil lead concentrations in excess of 200 mg/kg. EPA recommends that vegetable gardens should not be grown in soils with lead concentrations exceeding 200 mg/kg. Therefore, a voluntary program is in place in East Helena allowing and encouraging area residents whose yards have not been

cleaned up to replace their garden soils with clean soils. ASARCO provides those soils at no cost to the homeowner.

It appears that some grain fields in the study area are producing crops containing elevated concentrations of arsenic, cadmium, and lead. These fields are relatively close to the plant site. Only cadmium is significantly enriched above background in fields located more than 3 miles from the plant. Fields located more than 4 miles from the plant do not show significantly elevated concentrations above background of any element. Although some portion of the grain produced in the valley is consumed locally, agricultural products (wheat and barley) usually undergo significant processing prior to human consumption. During processing, the products grown in the Helena Valley are likely to be mixed with products from other non-impacted areas such that the resulting metals concentrations in the processed product should not be of concern.

Livestock

Two studies conducted during the remedial investigation on cattle of the Helena Valley identified elevated levels of metals in the local cattle. A survey conducted in 1985 concentrated on the levels of metals and arsenic in cattle blood and hair (EPA, 1987). A subsequent investigation (Hydrometrics, 1990) concentrated on levels of metals and arsenic in cattle livers, kidneys, and muscle tissue. The primary ingestion of livestock products by humans is muscle tissue, which is not generally metal-enriched in Helena Valley livestock. Occasional ingestion of beef liver or kidney tissue with elevated concentrations of arsenic or cadmium is believed to present a low risk to consumers. These beef products are typically associated with lower consumption levels compared to beef muscle; consequently, exposure potential is believed to be relatively low. Risk levels increase, however, if individuals ingest beef liver or kidney from locally raised cattle on a regular basis. It has been proposed that the Lewis and Clark Lead Education and Abatement Program include education to discourage liver and kidney consumption from locally raised livestock.

Fish

The U.S. Fish and Wildlife Service's report (U.S. Fish and Wildlife, 1987) concluded that metals concentrations in sediments and biota collected in Prickly Pear Creek upstream and downstream of the East Helena Smelter Superfund Site were not significantly different. However, metals concentrations appeared elevated at most Prickly Pear Creek sampling locations when compared to sediment and biota from reference sites. They

recommended periodic monitoring of the fish to evaluate changes in temporal trends in lead exposure. The January 2005 Supplemental Ecological Risk Assessment concluded that some aquatic receptor species in the creek may be slightly impacted due to elevated surface water concentrations of selenium downstream of the East Helena Site.

Wildlife - Waterfowl

The U.S. Fish and Wildlife Service's 1987 Lake Helena study also addressed waterfowl. Lake Helena mallards exhibited higher blood lead concentrations than mallards tested in nearby Canyon Ferry Reservoir. The study concluded that elevated metals in Lake Helena sediments could be contributing to the high blood lead in mallards and recommended additional monitoring and sampling activities. Through the RCRA program, EPA will further evaluate the situation with respect to waterfowl and determine whether additional action is warranted .

Slag Pile

The slag pile currently covers approximately 35-acres, and includes the slag pile and any contaminated soil under the slag pile.

Zinc Plant. In 1927, the Anaconda Company constructed a plant adjacent to the lead smelter for the purpose of recovering zinc from the smelter's waste slag. Asarco purchased this zinc plant in 1972, but operations were discontinued in 1982. This zinc plant was demolished in March 2005.

Ore Storage Areas

The ore storage area includes air, groundwater and surface water effects. In 1990, Asarco completed construction of a completely enclosed ore concentrates storage and handling building.